U·M·I

SHOULD READ VOLUME 105

ELSEVIER

Nuclear Instruments and Methods in Physics Research B 104 (1995) xi–xiv

NIM B
Beam Interactions with Materials & Atoms

Contents

Editorial vii
Conference photograph viii
Committees and Sponsors ix
UV-induced Caribbean transition in punch-treated organic structures
N. Betz, S. Bouffard, E. Dooryhee, L. Romana and C. Trautmann x

Section I. Basic Phenomena

Basic phenomena induced by swift heavy ions in polymers
S. Bouffard, B. Gervais and C. Leroy 1
General consideration of the radiation chemistry of polymers
A. Chapiro 5
The track structure in condensed matter
I.G. Kaplan 8
Calculations of heavy-ion track structure
M. Krämer 14
Free surface deformations of an irradiated solid
J. Grilhé and J.C. Girard 21
Photoradiation chemistry of polymers
V.K. Milinchuk 24
Lattice-solitons in radiation damage
F.M. Russell and D.R. Collins 30
Spatial energy deposition distribution by a keV-electron beam in resist layers for electron-beam lithography
H. Schmoranzer and M. Reisser 35
Time-dependent emission spectra from polysilane thin films irradiated by MeV ion beams
H. Shibata, S. Seki, S. Tagawa, Y. Yoshida and K. Ishigure 42

Section II. Surface and Bulk Modificiations

Swift heavy ion modification of polymers
E. Balanzat, N. Betz and S. Bouffard 46
Ion track grafting
N. Betz 55
Ion–chains interaction in polymers
L. Calcagno 63
Radiation physics and chemistry of surfaces
J.P. Duraud and A. Le Moël 71
Observation and chemical treatment of heavy-ion tracks in polymers
C. Trautmann 81
Degradation of polystyrene thin films under d, ^{4}He and ^{12}C irradiation studied by ion beam analysis: effects of energy loss, sample thickness and isotopic content
F. Abel, V. Quillet and M. Schott 86

0168-583X/95/$09.50 © 1995 Elsevier Science B.V. All rights reserved

Particle track detection and relaxation transitions in polymer
P.Yu. Apel, A.Yu. Didyk, B.I. Fursov, L.I. Kravets, V.G. Nesterov and G.S. Zhdanov 91

The influence of dose rate and oxygen on the irradiation induced degradation in ethylene-propylene rubber
S. Baccaro, B. Caccia, S. Onori and M. Pantaloni 97

Mechanical properties of polyvinylpyrrolidone (PVP) hydrogels undergoing radiation
S. Baccaro, L.A. Pajewski, G. Scoccia, R. Volpe and J.M. Rosiak 100

Effects of irradiation on PVC compounds
P. Bataille, I. Ulkem and H.P. Schreiber 103

Pulse radiolysis studies of the action of antioxidants in polyethylene and model systems: 4-methyl-2,6-di-t-butyl-phenol
O. Brede 106

Amorphization kinetics of poly(vinylidene fluoride) on high-energy ion irradiation
V. Chailley, E. Balanzat and E. Dooryhee 110

Heavy ions track structure in a PETP
K. Ciesla and W. Starosta 115

ESCA characterization of heparin-like fluoropolymers obtained by functionalization after grafting induced by swift heavy ion irradiation
S. Dapoz, N. Betz, M.-J. Guittet and A. Le Moël 120

Characterisation of energetic heavy ion track in PVDF: Production of PVDF track-etched membrane and application
C. Daubresse, T. Sergent-Engelen, E. Ferain, Y.-J. Schneider and R. Legras 126

Ion beam modification of polyimide membranes for gas permeation
M. Escoubes, J.Y. Dolveck, J. Davenas, X.L. Xu and G. Boiteux 130

Modifications in the chemical bonding and optical absorption of PPS by ion bombardment
L.S. Farenzena, R.M. Papaléo, A. Hallén, M.A. de Araújo, R.P. Livi and B.U.R. Sundqvist 134

Radiation-induced grafting of styrene onto polyimide ion track membranes
K. Friese, V. Placek, R. Mehnert, N. Angert, R. Spohr and Ch. Trautmann 139

Structural study of polystyrene grafted in irradiated polyvinylidene fluoride thin films
G. Gebel, E. Ottomani, J.J. Allegraud, N. Betz and A. Le Moël 145

Mechanism of radiation-induced degradation of poly(methyl methacrylate) — temperature effect
T. Ichikawa 150

Primary reactions in the electron-induced polymerization of acrylates
W. Knolle and R. Mehnert 154

Perdiodic structuration of polymer surfaces with the excimer laser radiation
S. Lazare, M. Bolle, A. Cros and L. Bellard 159

Grafting of acrylic acid onto polypropylene – comparison of two pretreatments: γ-irradiation and argon plasma
I.L.J. Dogué, N. Mermilliod and R. Foerch 164

Mechanisms of radiation induced cationic polymerization in the presence of onium salts
E. Malmström, P.E. Sundell, A. Hult and S.E. Jönsson 168

Diffusion of metals deposited on a polyimide film (Kapton) under and out of irradiation
N. Marin and Y. Serruys 175

Grafting of styrene in polyvinylidene fluoride by high energy ion irradiation
R. Percolla, P. Musumeci, L. Calcagno, G. Foti and G. Ciavola 181

Excimer laser ($\lambda = 193$ nm) versus Al Kα X-ray damages on polymer surfaces: an XPS (core and valence levels) analysis of polytetrafluoroethylene, polypropylene and polyethylene
J.J. Pireaux, R. de Meulemeester, E.M. Roberfroid, Ch. Grégoire, M. Chtaïb, Y. Novis, J. Riga and R. Caudano 186

Effects of ionizations and displacements on the hardness and optical absorption of some ion irradiated polymers
J.C. Pivin, P. Viel, G. Zalczer and G. Marletta 192

Gas permeability and cross section of latent ion tracks in polymers
G. Remmert, Y. Eyal, B.E. Fischer and R. Spohr 197
Solvent-induced sensitization of ion tracks in PET analyzed by small-angle X-ray scattering and differential scanning calorimetry
T. Steckenreiter, H. Fuess, M. Stamm and C. Trautmann 200
Polymerization of pyrrole into track membranes
N.I. Zhitariuk, A. Le Moël, N. Mermilliod and C. Trautmann 204
Electronic stopping and etched particle tracks in polymers. Part II: boron and lithium tracks
J.L. Zhu, L.T. Chadderton, D. Fink, S.A. Cruz, S. Ghosh and D.Z. Zhu 208

Section III. Advanced Materials

Properties of ferroelectric polymers under high pressure and shock loading
F. Bauer 212
Present and future developments in polymer radiation
A. Charlesby 217
Dipolar glass behaviour of a ferroelectric polymer after irradiation
J.F. Legrand, B. Daudin and E. Bellet-Amalric 225
Prospects for nonlinear optics
R.A. Lessard and G. Manivannan 229
Reactive recycling of multiphase polymer systems through electron beam
T. Czvikovszky. 233
IAEA's programme on applied radiation chemistry – polymers
R.M. Iyer and V. Markovic 238
Doping of ion implanted polyethylene with metallocarborane
V. Hnatowicz, J. Vacík, J. Červená, V. Švorčík, V. Rybka, V. Popok, D. Fink and R. Klett 241
Processing of polymer surfaces by laser radiation
E.W. Kreutz, H. Frerichs, J. Stricker and D.A. Wesner 245
Track membranes of the third generation, (TMG-3): their properties and industrial application
V.I. Kuznetsov, L.V. Kuznetsov and V.D. Shestakov 250
Excimer lasers for surface engineering of polymer-based composites
L.D. Laude, N. Boutarek and K. Kolev 254
Structure–properties relationship of irradiated LDPE/EVA blend
Ma.E. Martínez-Pardo, Ma.P. Zuazua, V. Hernández-Mendoza, J. Cardoso, R. Montiel and H. Vázquez 258
Electron beam processing for polymerization induced phase separation: Preparation of polymer dispersed liquid crystal films
U. Maschke, X. Coqueret and C. Loucheux 262
Modification of phase transitions in swift heavy ion irradiated and MMA-grafted ferroelectric fluoropolymers
E. Petersohn, N. Betz and A. Le Moël 267
Thermal switching of grafted single ion tracks
N. Reber, H. Omichi, R. Spohr, M. Tamada, A. Wolf and M. Yoshida. 275
Carbon ion induced modifications of the Curie transition in ferroelectric polymers
D. Schlößer, A. Le Moël and E. Dooryhée 278
Time resolved study of the high energy radiation initiated polymerization
E. Takács and L. Wojnárovits 282
Effect of UV and gamma radiation on Rn222 permeation through polyvinyl chloride (PVC). Application to the packaging of radium sources for the purpose of storage
E. Tomasella, V. Labed, D. Klein, M.C. Robé, Ph. Cetier and A. Chambaudet 285
Electrolyte transport in charged single ion track capillaries
A. Wolf, N. Reber, P.Yu. Apel, B.E. Fischer and R. Spohr. 291

Section IV. Biological Applications

Biocompatible and biofunctional membranes by means of radiation techniques
I. Kaetsu 294
Synthesis of intelligent materials using ion beams
H. Omichi 302
DNA radiolysis. Mapping of the gene regulation domains
M. Spotheim-Maurizot, J. Franchet-Beuzit, V. Isabelle, L. Tartier and M. Charlier 308
Fragmentation of dinucleotides d(ApAp) following K shell ionization of phosphorus atom by monochromatic soft X-rays
H. Frohlich, M. Le Maire, F. Guillot, M. Tronc, J.M. Cosset and C. Le Sech 314
Radiation-induced polymerization of a phospholipid for developing artificial red blood cells
F. Hosoi, H. Omichi, K. Akama, K. Awai, S. Tokuyama and T. Satoh 318
PMMA surface modification under keV and MeV ion bombardment in relation to mammalian cell adhesion
J.-B. Lhoest, J.-L. Dewez and P. Bertrand 322
Calculated radiosensitivities of different forms of DNA in solution
V. Michalik, M. Spotheim-Maurizot and M. Charlier 328
Model pores for biological membranes: the properties of track-etched membranes
C.A. Pasternak, G.M. Alder, P.Y. Apel, C.L. Bashford, Y.E. Korchev, A.A. Lev, T.K. Rostovtseva and N.I. Zhitariuk 332
Hydrogels for biomedical purposes
J.M. Rosiak, P. Ulański and A. Rzeźnicki 335
Physico-chemical behaviour of β irradiated plastic materials currently used as packagings and medical products
N. Yagoubi, A. Baillet, F. Pellerin and D. Ferrier 340

Section V. Experimental

Industrial applications of ion beams: GANIL approach and prospects
H. Delagrange 345
Electron beams in research and technology
R. Mehnert 348

Author index 359